

10W CAR RADIO AUDIO AMPLIFIER

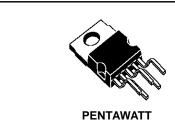
DESCRIPTION

The TDA 2003 has improved performance with the same pin configuration as the TDA 2002.

The additional features of TDA 2002, very low number of external components, ease of assembly, space and cost saving, are maintained.

The device provides a high output current capability (up to 3.5A) very low harmonic and cross-over distortion.

Completely safe operation is guaranteed due to protection against DC and AC short circuit between all pins and ground, thermal over-range, load dump voltage surge up to 40V and fortuitous open ground.



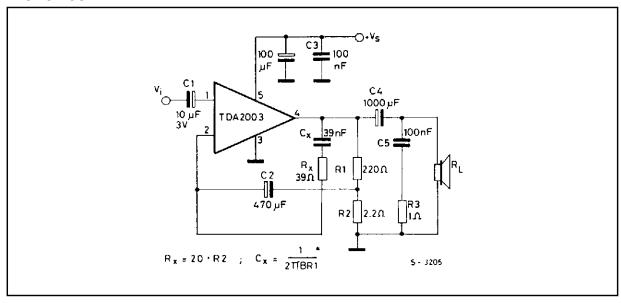
ORDERING NUMBERS : TDA 2003H

TDA 2003V

ABSOLUTE MAXIMUM RATINGS

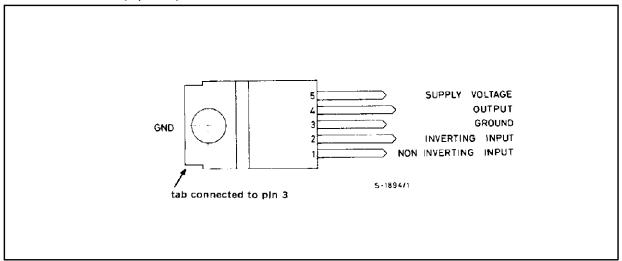
Symbol	Parameter	Value	Unit	
Vs	Peak supply voltage (50 ms)	40	V	
Vs	DC supply voltage	28	V	
Vs	Operating supply voltage	18	V	
Ιο	Output peak current (repetitive)	3.5	Α	
lo	Output peak current (non repetitive)	4.5	Α	
P _{tot}	Power dissipation at T _{case} = 90°C	20	W	
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C	

TEST CIRCUIT

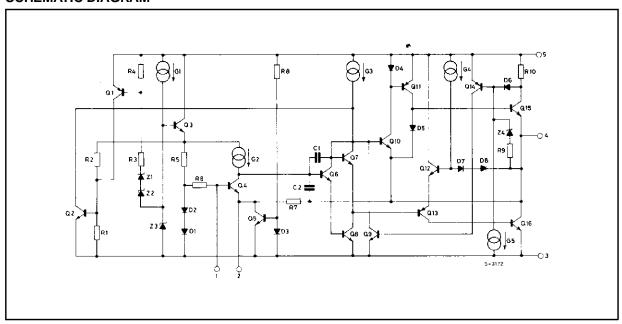


April 1995 1/12

PIN CONNECTION (top view)



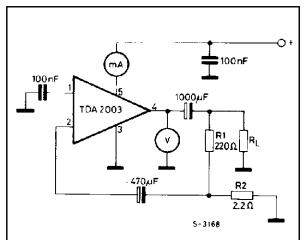
SCHEMATIC DIAGRAM



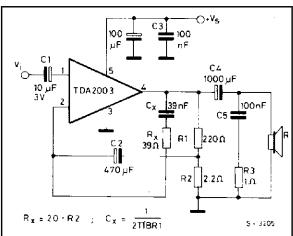
THERMAL DATA

Symbol	Parameter	Value	Unit
R _{th-j-case}	Thermal resistance junction-case max	3	°C/W

DC TEST CIRCUIT



AC TEST CIRCUIT



ELECTRICAL CHARACTERISTICS ($V_s = 14.4V$, $T_{amb} = 25$ °C unless otherwise specified)

mbol Parameter	Test conditions	Min.	Тур.	Max.	Unit
----------------	-----------------	------	------	------	------

DC CHARACTERISTICS (Refer to DC test circuit)

Vs	Supply voltage	8		18	V
Vo	Quiescent output voltage (pin 4)	6.1	6.9	7.7	\ \
I _d	Quiescent drain current (pin 5)		44	50	mA

AC CHARACTERISTICS (Refer to AC test circuit, Gv = 40 dB)

Po	Output power	d = 10% f = 1 kHz	$R_L = 4\Omega$ $R_L = 2\Omega$ $R_L = 3.2\Omega$ $R_L = 1.6\Omega$	5.5 9	6 10 7.5 12	W W W
V _{i(rms)}	Input saturation voltage			300		mV
Vi	Input sensitivity	f = 1 kHz $P_0 = 0.5W$ $P_0 = 6W$ $P_0 = 0.5W$ $P_0 = 10W$	$R_L = 4\Omega$ $R_L = 4\Omega$ $R_L = 2\Omega$ $R_L = 2\Omega$		14 55 10 50	mV mV mV

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter		Test conditions	Min.	Тур.	Max.	Unit
В	Frequency response (-3 dB)		$P_0 = 1W$ $R_L = 4\Omega$	40 to 15,000		00	Hz
d	Distortion		$ \begin{cases} f = 1 \text{ kHz} \\ P_o = 0.05 \text{ to} 4.5 \text{W} & R_L = 4 \Omega \\ P_o = 0.05 \text{ to} & 7.5 \text{W} & R_L = 2 \Omega \\ \end{cases} $		0.15 0.15		% %
Ri	Input resistance (pin 1)		f = 1 kHz	70	150		kΩ
G _v	Voltage gain (open loop)		f = 1 kHz f = 10 kHz		80 60		dB dB
G _v	Voltage gain (closed loop)		$f = 1 \text{ kHz}$ $R_L = 4\Omega$	39.3	40	40.3	dB
e _N	Input noise voltage	(0)			1	5	μV
i _N	Input noise current ((0)			60	200	pА
η	Efficiency	·			69 65		% %
SVR	Supply voltage rejection		$ f = 100 \text{ Hz} $ $V_{ripple} = 0.5V $ $R_g = 10 \text{ k}\Omega \qquad R_L = 4\Omega $	30	36		dB

⁽⁰⁾ Filter with noise bandwidth: 22 Hz to 22 kHz

Figure 1. Quiescent output voltage vs. supply voltage

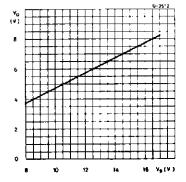


Figure 2. Quiescent drain current vs. supply voltage

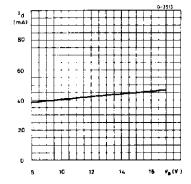


Figure 3. Output power vs. supply voltage

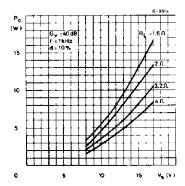


Figure 4. Output power vs. load resistance R_L

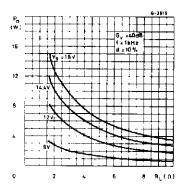


Figure 5. Gain vs. input sensivity

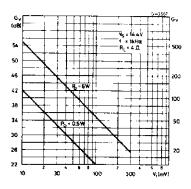


Figure 6. Gain vs. input sensivity

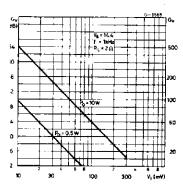


Figure 7. Distortion vs. output power

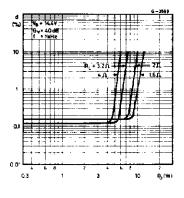


Figure 8. Distortion vs. frequency

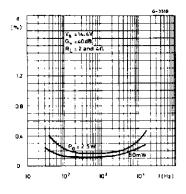


Figure 9. Supply voltage rejection vs. voltage gain

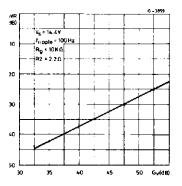


Figure 10. Supply voltage rejection vs. frequency

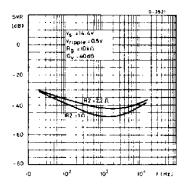


Figure 11. Power dissipation and efficiency vs. output power ($R_L = 4\Omega$)

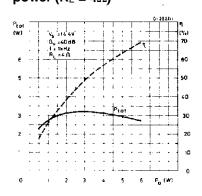


Figure 12. Power dissipation and efficiency vs. output power ($R_L = 2\Omega$)

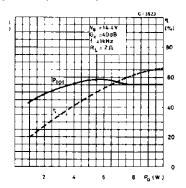


Figure 13. Maximum power dissipation vs. supply voltage (sine wave operation)

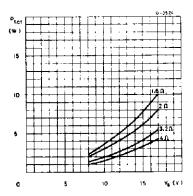


Figure 14. Maximum allowable power dissipation vs. ambient temperature

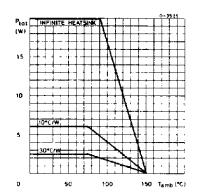
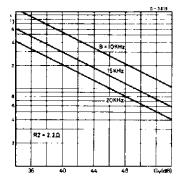


Figure 15. Typical values of capacitor (Cx) for different values of frequency reponse



APPLICATION INFORMATION

Figure 16. Typical application circuit

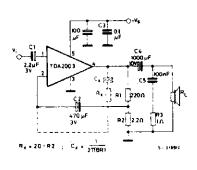
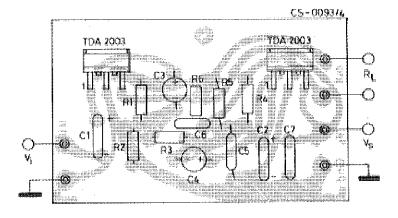


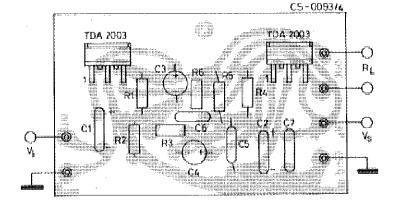
Figure 17. P.C. board and component layout for the circuit of fig. 16 (1:1 scale)



tion application circuit (*)

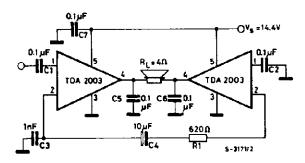
(*) The values of the capacitors C3 and C4 are different to optimize the SVR (Typ. = 40 dB)

Figure 18. 20W bridge configura- Figure 19. P.C. board and component layout for the circuit of fig. 18 (1 : 1 scale)



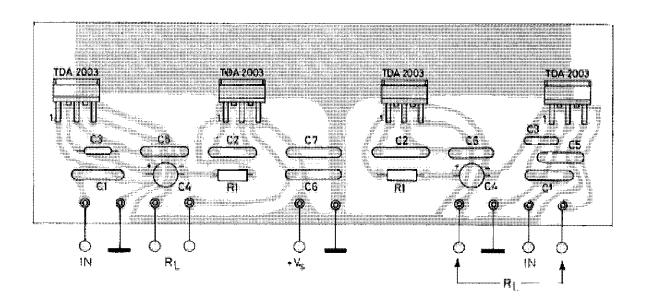
APPLICATION INFORMATION (continued)

Figure 20. Low cost bridge configuration application circuit (*) ($P_0 = 18W$)



(*) In this application the device can support a short circuit between every side of the loudspeaker and ground.

Figure 21. P.C. board and component layout for the low-cost bridge amplifier of fig. 20, in stereo version (1 : 1 scale)



BUILT-IN PROTECTION SYSTEMS

Load dump voltage surge

The TDA 2003 has a circuit which enables it to withstand a voltage pulse train, on pin 5, of the type shown in fig. 23.

If the supply voltage peaks to more than 40V, then an LC filter must be inserted between the supply and pin 5, in order to assure that the pulses at pin 5 will be held within the limits shown in fig. 22. A suggested LC network is shown in fig. 23. With this network, a train of pulses with amplitude up to 120V and width of 2 ms can be applied at point A. This type of protection is ON when the supply voltage (pulsed or DC) exceeds 18V. For this reason the maximum operating supply voltage is 18V.



Figure 22.

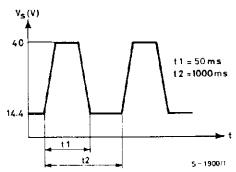


Figure 23.

Short-circuit (AC and DC conditions)

The TDA 2003 can withstand a permanent short-circuit on the output for a supply voltage up to 16V.

Polarity inversion

High current (up to 5A) can be handled by the device with no damage for a longer period than the blow-out time of a quick 1A fuse (normally connected in series with the supply).

This feature is added to avoid destruction if, during fitting to the car, a mistake on the connection of the supply is made.

Open ground

When the radio is in the ON condition and the ground is accidentally opened, a standard audio amplifier will be damaged. On the TDA 2003 protection diodes are included to avoid any damage.

Inductive load

A protection diode is provided between pin 4 and 5 (see the internal schematic diagram) to allow use of the TDA 2003 with inductive loads.

In particular, the TDA 2003 can drive a coupling transformer for audio modulation.

DC voltage

The maximum operating DC voltage on the TDA 2003 is 18V.

However the device can withstand a DC voltage up to 28V with no damage. This could occur during winter if two batteries were series connected to crank the engine.

Thermal shut-down

The presence of a thermal limiting circuit offers the following advantages:

- an overload on the output (even if it is permanent), oran excessive ambient temperature can be easily withstood.
- 2) the heat-sink can have a smaller factor compared with that of a conventional circuit. There is no device damage in the case of excessive junction temperature: all that happens is that P₀ (and therefore P_{tot}) and I_d are reduced.

Figure 24. Output power and drain current vs. case temperature ($R_L = 4\Omega$)

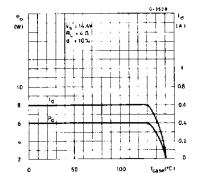
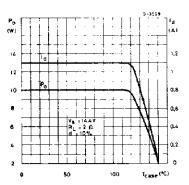


Figure 25. Output power and drain current vs. case temperature ($R_L = 2\Omega$)



PRATICAL CONSIDERATION

Printed circuit board

The layout shown in fig. 17 is recommended. If different layouts are used, the ground points of input 1 and input 2 must be well decoupled from the ground of the output through which a rather high current flows.

Assembly suggestion

No electrical insulation is required between the

package and the heat-sink. Pin length should be as short as possible. The soldering temperature must not exceed 260°C for 12 seconds.

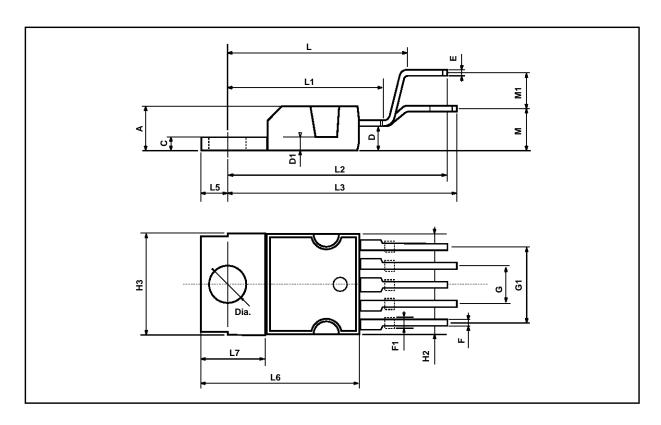
Application suggestions

The recommended component values are those shown in the application circuits of fig. 16. Different values can be used. The following table is intended to aid the car-radio designer.

Component	Recommmended value	Purpose	Larger than recommended value	Smaller than recommended value C1
C1	2.2 μF	Input DC decoupling		Noise at switch-on, switch-off
C2	470 μF	Ripple rejection		Degradation of SVR
C3	0.1 μF	Supply bypassing		Danger of oscillation
C4	1000 μF	Output coupling to load		Higher low frequency cutoff
C5	0.1 μF	Frequency stability		Danger of oscillation at high frequencies with inductive loads
C _X	$\cong \frac{1}{2 \pi B R1}$	Upper frequency cutoff	Lower bandwidth	Larger bandwidth
R1	(G _v -1) • R2	Setting of gain		Increase of drain current
R2	2.2 Ω	Setting of gain and SVR	Degradation of SVR	
R3	1 Ω	Frequency stability	Danger of oscillation at high frequencies with inductive loads	
R _X	≅ 20 R2	Upper frequency cutoff	Poor high frequency attenuation	Danger of oscillation

PENTAWATT PACKAGE MECHANICAL DATA

DIM.		mm			inch		
DIIVI.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Α			4.8			0.189	
С			1.37			0.054	
D	2.4		2.8	0.094		0.110	
D1	1.2		1.35	0.047		0.053	
Е	0.35		0.55	0.014		0.022	
F	0.8		1.05	0.031		0.041	
F1	1		1.4	0.039		0.055	
G		3.4		0.126	0.134	0.142	
G1		6.8		0.260	0.268	0.276	
H2			10.4			0.409	
H3	10.05		10.4	0.396		0.409	
L		17.85			0.703		
L1		15.75			0.620		
L2		21.4			0.843		
L3		22.5			0.886		
L5	2.6		3	0.102		0.118	
L6	15.1		15.8	0.594		0.622	
L7	6		6.6	0.236		0.260	
М		4.5			0.177		
M1		4			0.157		
Dia	3.65		3.85	0.144		0.152	



Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1995 SGS-THOMSON Microelectronics - All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thaliand - United Kingdom - U.S.A.

